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A Discussion on Smart City Management Based on Meta-Synthesis Method

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Abstract
This paper proposes an idea that Smart City could be considered to be an open complex giant system, from which consensus emergence can be demonstrated and handle by meta-synthesis. It clarified the differences between smart city management and traditional city management. Smart city can be managed with the theory of processing complex system--from qualitative to quantitative method of the integrated method, which was put forward by QIAN Xuesen. Finally the smart city management model is established.

Key words: Smart city; Meta-synthesis methodology; Information management

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INTRODUCTION
With the rapid development of information technology, the urban pattern change process also speeds up faster and faster. Smart City, a new star of the urban development process, is sought after by the world. The construction of smart city likes a raging fire. At the same time, the management mode will change.

In the context of fast-growing urban population and expanding urban, security issues, traffic congestion, food safety, medical resource constraints, environmental pollution, public health emergencies, distribution of resources, employment pressure become big problems. It is very necessary for modern city to be fit into full range of information management. A "smart city" and "smart city group" in the existing city information platform for the construction will be a "wise" choice. With the development of the city, modern city management and services tend to be digitized and gradual development of wisdom, and provinces are also actively promoting things in the intelligent transportation, smart grid, smart city management, energy conservation and other aspects of the pilot applications. Meta-Synthesis Method's essence is to form expert group, statistical data and information organically into a highly intelligent human computer interaction system. It has integrated a variety of knowledge integration, from perceptual to rational, from qualitative to quantitative. According to the characteristics of smart city, in the full analysis of the open complex foundation, QIAN Xuesen's Meta-Synthesis is integrated into management model.

1. OPEN COMPLEX GIANT SYSTEM
Starting from Bertalanffy, systematic research on the environmental systems emphasizes openness. In China, QIAN put forward the concept of an open complex giant system (Xu, Gu & Che, 2010), from the nature of the system, according to the complexity of the relationship between subsystems and the number of species composition, you can put the system into a simple system and giant system: i) If the number of sub- components of the system is relatively small and the relationship between them is relatively simple, the system is called a simple system, such as a measuring instrument ; ii) If the number of subsystems is enormous, as thousands, then the system

is known as giant system ; iii) The sub-system of the giant system is not too much (several dozens of species), and the relationship between them is relatively simple. It is called a simple giant system, such as a laser system; 4). If there are many kinds of subsystems, which have hierarchies and complex relationship between them, it is a complex giant system.

Furthermore, if the system is open, it is called the open complex giant system. In this concept, QIAN and others give new meaning to the term of open: i) Open means that the system not only exchanges material, energy, information with the environment generally, and accepts importation and environmental disturbances, provides output to the environment, but also adapts proactively and evolves ; ii) Open also means the system behavior should pay attention to the environmental when it is analyzed, designed and used. System operation considers the environment protection. iii) Open means that the system is not yet established, unchanging, finished, but dynamic and evolving, the continual emergence of new phenomena and new problems. Researchers must treat the systems science with open mind.

2. META-SYNTHESIS METHOD FROM QUALITATIVE TO QUANTITATIVE

In the late 1980s, QIAN proposed Meta-synthesis Method from Qualitative to Quantitative to process open complex giant system (Xu, Gu & Che, 2010). Meta-synthesis method (Gu, 2004) is essentially a highly intelligent human-computer interaction system, which is combined with expert groups, statistical data and information. It integrates a comprehensive range of knowledge, rising from perceptual to the rational, from a qualitative to quantitative features. Features include: Combination of qualitative and quantitative research studies organically; Knowledge and experience combined with scientific theory; Combination comprehensive multi-disciplinary with application of systems thinking to research; Unity the macro and micro research according to the hierarchy of complex giant system; It is supported by a large computer system with the functions of not only the management information systems, decision support systems but also a comprehensive integration capabilities.

Meta-synthesis Method pointed out the process and the process of directionality and repeatability of solving complex giant system and the complexity of the issues.

3. COMPLEX GIANT SYSTEM ANALYSIS ABOUT SMART CITY AND SMART CITY MANAGEMENT

3.1 Smart City

More than 200 cities around the world are in full swing into the new trend of smart city since smart city has been proposed by IBM. Smart city has become a hot topic of urban development. Our cities are building highlight the personality of smart city to promote the new urban development, according to their local characteristics. Guangzhou transforms from information city to smart city, and Chengdu proposes the vision of “smart cities, wisdom life, and Wuhan has taken a substantial step in our first smart city construction.

Smart City (Lu, 2004; Wang, 2011) means that, in the process of urban development, in order to perform the duties of economic regulation, market supervision, social management and public services, local governments make full use of information and communication technologies, such as Internet of things and internet, to smartly perceive, analyze and integrate city’s environment, resources, infrastructure, public safety, city services, public utilities, city participants’ operational state and their demand for government functions, and further make the appropriate government action. The purpose of Smart City is to form virtuous cycle of city systems, to create a better urban environment of life, work, rest and entertainment. Smart City requires each core system should acquire smart, and Smart City is a smart macro-system. The six smart core systems have specific subsystems, such as smart medical, smart education.

Table 1
The Smart City’s Six Core Systems

Six core system	System components	System classification
People's social network	Public safety; (fire, police intelligence, epidemic diseases), health; education; quality of life	Social networks
Government regulation of business	Business systems need to comply with administrative management, political environment, economic planning, regulation policies	
Transportation	Urban road and public transport network; sea and air transport	Infrastructure
Communications	communications infrastructure: cable telephony, broadband, wireless networks, cable TV	
Water	Water cycle, water supply, water clean	
Energy	Energy production, energy transportation systems, waste disposal	

Source: According to IBM Institute for Business Value, “Smart City in China”, pp.8-12, Nov. 2008.

3.2 Smart City Is a Kind of Open Complex Giant System

Microscopic part of the modern city is people, and people themselves are open complex giant system. The city put so many people together, with energy, information, capital, labor, various economic, scientific knowledge and life infrastructure as the regional economy, politics, culture, education and science and technology information center. The city is not a simple superposition of these functions (Lu, 2011), in fact, is a common entirety which is mutually reinforcing and affecting each other. The city is a system, and it is an open complex giant system, then the management of modern urban should comply with the law of complex giant system. The smart city is to become more wisdom; it does not mean applying an installed system. The design, construction and improvement of smart city are processes with interaction and practice. In the future, with a new generation of networking, cloud computing, decision analysis and optimization of information technology, and through perception, interconnected and intelligent manner, the city's physical infrastructure, information infrastructure, social infrastructure and business infrastructure are connected up to become the next generation of intelligent infrastructure, which enable all areas of the city and manifest the relationship between the various subsystems. As if the city is put on the network of the nervous system. It is a system of systems which can make command decision, real-time response and coordinate the operation (Lu, 2011). Therefore smart city is a kind of open complex giant system.

3.3 The Difference Between Traditional Urban Management and Smart City Management

Urban management refers to guide decisions about the conduct of the operation and development, regulate coordination, service and business of the city, which is based on urban basic information flow, through the use of decision-making, planning, organizing, directing, coordinating, controlling and a series of mechanisms, with legal, economical, administrative, technical and other means, through the interaction between the government, the market and society (Song, Chen, 2006). Foreign management models pursue the concept of" Trend administrative decentralization" and "people-oriented" and "public administration market" (Zhou, Song, 2009). Some of our cities, such as Beijing's Dongcheng District achieved good results through the implementation of "urban grid management" (Wang, Fan, Yang, & Zhang, 2007). However, with the accelerating construction of smart city, urban management problems are emergent. Traditional urban management is independently managed by industry, for examples, urban infrastructure communication cables, water pipes, gas pipes, electrical conduit, cable TV, sewer equally belong to different industries, independent of each other, laying and maintenance of their respective trenches are very complex and difficult. High incidences of criminal cases tend to be the boundary position of each administrative region, but urban security is fragmented region. The concept of traditional urban management results in inefficient resource utilization and management.

The concept of smart city management are about systematic management, three-dimensional management and integrated management, which should be ecological, green, science. Smart city management ultimately achieves sustainable, people-oriented, in harmony with the natural environment. With the accelerated pace of smart city, traditional urban management model must change adaptively. According to the characteristics and development of smart city, higher requirements of management model are proposed: First, the management philosophy transforms from oriented economy to social service-oriented. Second, the management structure transforms from the flat vertical-independent type to collaborative management. Third, the management objects transform from the management of people to the management material and information flow. Fourth, the management style transforms from the past administration to a combination between administration and social self-regulation. Fifth, the management system transforms from a single supply system to diversify supply system.

4. SMART CITY MANAGEMENT BASED ON META-SYNTHESIS METHOD

4.1 Steps of Meta-Synthesis Method

According to the meta-synthesis method discussed by QIAN and other scientists (Xu, Gu, & Che, 2010), the urban management approach should include the following steps:

Step1: Qualitative meta-synthesis of urban management. Multi-disciplinary, cross-over study and a full range of analysis and empirical hypothesis are carried out about urban management problems to form qualitative judgments by different urban management departments, consisting of experts in various fields of social expert system. It is an empirical judgment because it is without rigorous scientific proof.

Step 2: Combination with qualitative and quantitative meta-synthesis method in urban management. Basic data, the functional departments of data and information system are established. Based on index system to solve management problems and the model system, through information technology, data mining, system simulation and modeling experiments, a quantitative description and diagnosis on the empirical hypothesis of issues raised forward are given to verify them correct or not. If new information is increased, this process may be repeated several times.

Step3: Urban management is from qualitative to quantitative meta-synthesis method. System simulation

and experimental results are integrated by the city managers and experts in various fields. Through man-machine combination, repeated contrast, successive approximation, the comprehensive integration from qualitative to quantitative is not finished until quantitative results are credible. If quantitative results negate the original empirical judgments, it is also a new understanding, and then a new empirical judgment will be presented.

Step4: Urban administration is from the quantitative results to qualitative decision management. A quantitative description of the state of the city is got by index system, modeling, simulation and modeling systems according which city managers and experts in various fields quantify the problems of urban management. On this basis, the quantitative decision management is raised from the qualitative results, and ultimately is used to guide the city's comprehensive management, ensuring stable operation of urban systems.

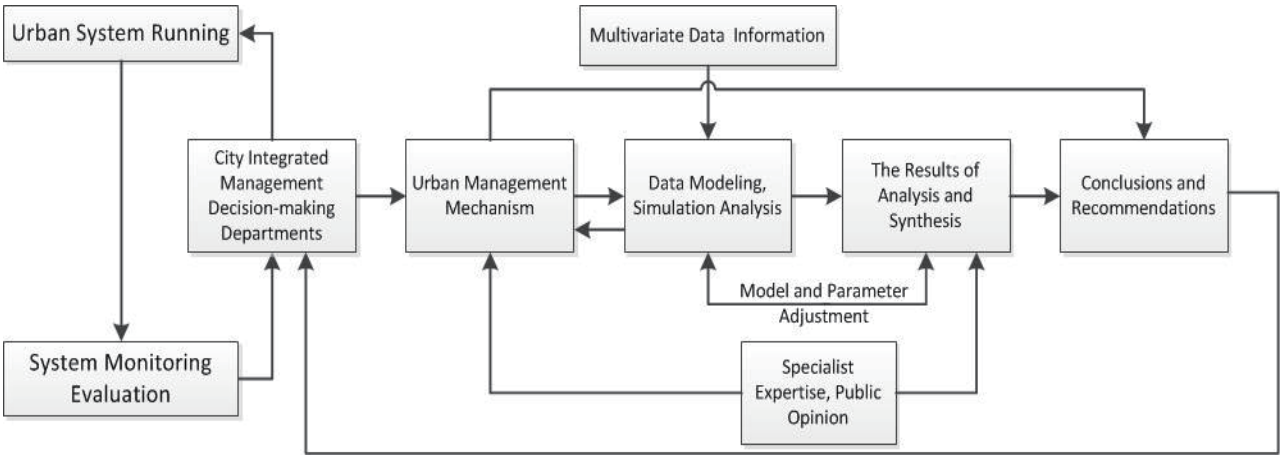

Figure 1
Steps of Meta-Synthesis Method About Urban Management

4.2 Smart City Management Based on Meta-Synthesis Method

Based on the model of smart city, a commander of the center should be established - smart integrated management control center. The six core systems of smart city are in comprehensive integration. Through the Internet of things, cloud computing, data mining, information technology and other high-tech means, a wide range of qualitative understanding forms into quantitative understanding t, and then qualitative guidance of urban management center is draw from a quantitative judgment. Effective control and service are executed in fully taking into account the real-time status of each system to react to possible changes in the requirements and decisions, so as to achieve better management of the smart city.

Through meta-synthesis method, all of the city managers, experts in various fields and public thinking, wisdom, accumulated experience and a variety of intelligence, a variety of scientific and information technology means are integrated under the support of support modern information and communication technology, simulation, artificial intelligence and other modern scientific technologies. A wide range of qualitative knowledge is formed into quantitative understanding by the use of data mining, text mining, mining models, mining and other expert opinions, according from which qualitative guidance on urban management is achieved.

Smart City Command Center coordinates the overall operation of Smart City. It contains urban management policies dashboard, which is municipal policy management console to integrate services weather, traffic. First, to achieve the objectives of each period, Smart City running should integrate the medium, short and long-term comprehensive planning. Fully taking the real-time state of the system into account, the console analyses the specific trend of the entire city to make management simulation, forecasting, decision. Secondly, command Center is Smart City's "general center. It commands and coordinates the smart serves "sub-center", to forms macro-system of Smart City. City command center frame makes effective control responds to the changes that may occur and then services urban infrastructure. Finally, command center is responsible for data, hardware and software's routine maintenance and system upgrading.

There is an important department-Comprehensive management department in the city command center. It is city integrated management decision-making department. Through Meta-Synthesis Method, the department integrates expert experience data, model and knowledge to make system reconstruction. Reconstruction analysis is designed to deal with the relationship between each subsystem and the whole problem. Reconstruction analysis involves the recognition and reconstruction. The former infer the whole system of information from

subsystem information, and then the latter constitutes a general system with a certain degree of approximation duplicate removal. Then information for decision making is provided.

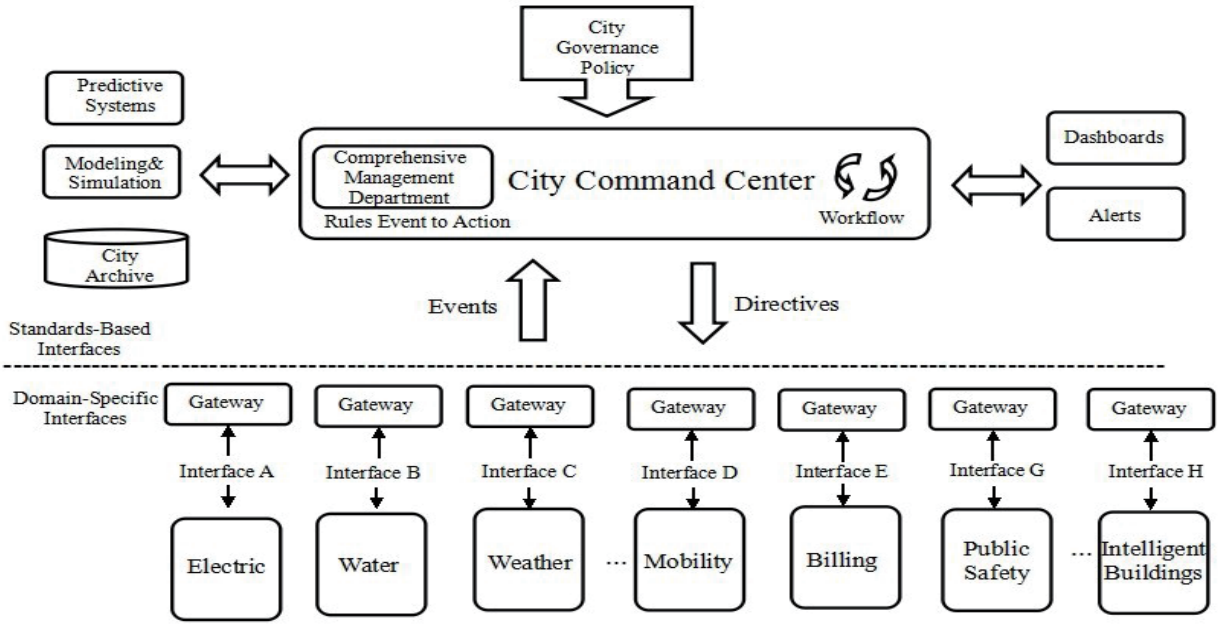

Figure 2
Smart City Management Model Diagram

CONCLUSION

This paper proposes an idea that Smart City could be considered to be an open complex giant system, from which consensus emergence can be demonstrated and handle by meta-synthesis method. It clarified the differences between smart city management and traditional city management. Finally the smart city management model is established.

Meta-synthesis method to the complex giant system has important significance, Along with the acceleration of smart city's constructing, management must also be innovative. Urban management workers should grasp the characteristics of smart city under the field of information technology. Building smart city is an irresistible trend of urban development and its management model also has a great space for development and research.

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